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in part. This mound exhibited at the top an elliptical boundary line of projecting points of stones; the ellipse measuring twelve feet by nine feet in its axis. No stones appeared at the surface, except in the curved bounds of this ellipse. The excavation was made through one end of this ellipse, and an irregularly laid stone wall was found extending from the top of the mound to the bottom at this place. The partial excavation made indicated that such a wall followed the elliptical line of projecting stones around the mound, inclosing a mass of earth within. Near the bottom at the place opened was found, extending inward from the wall towards the center of the mound, a vault-like opening. This, however, may have resulted accidentally by reason of the immethodical manner in which the wall was laid up. No human remains or other relics were found in making this imperfect examination of this mound.

It was hoped that opportunity would admit of a more thorough examination of the Fort Leavenworth mounds. Yet, while what has been done affords materials for but little additional to the contributions of scientific knowledge brought in at the meetings of this Academy, what is here presented may prove of service, as leading to investigations yet to be made in the direction of determining to what extent the works of the mound builders exist in Kansas. These mounds are, it is believed, the only ones yet seen in Kansas, of which any record has been made.

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## ON THE DERMAL COVERING OF A MOSASAUROID REPTILE.

(*Liodon dyspelor* Cope.)

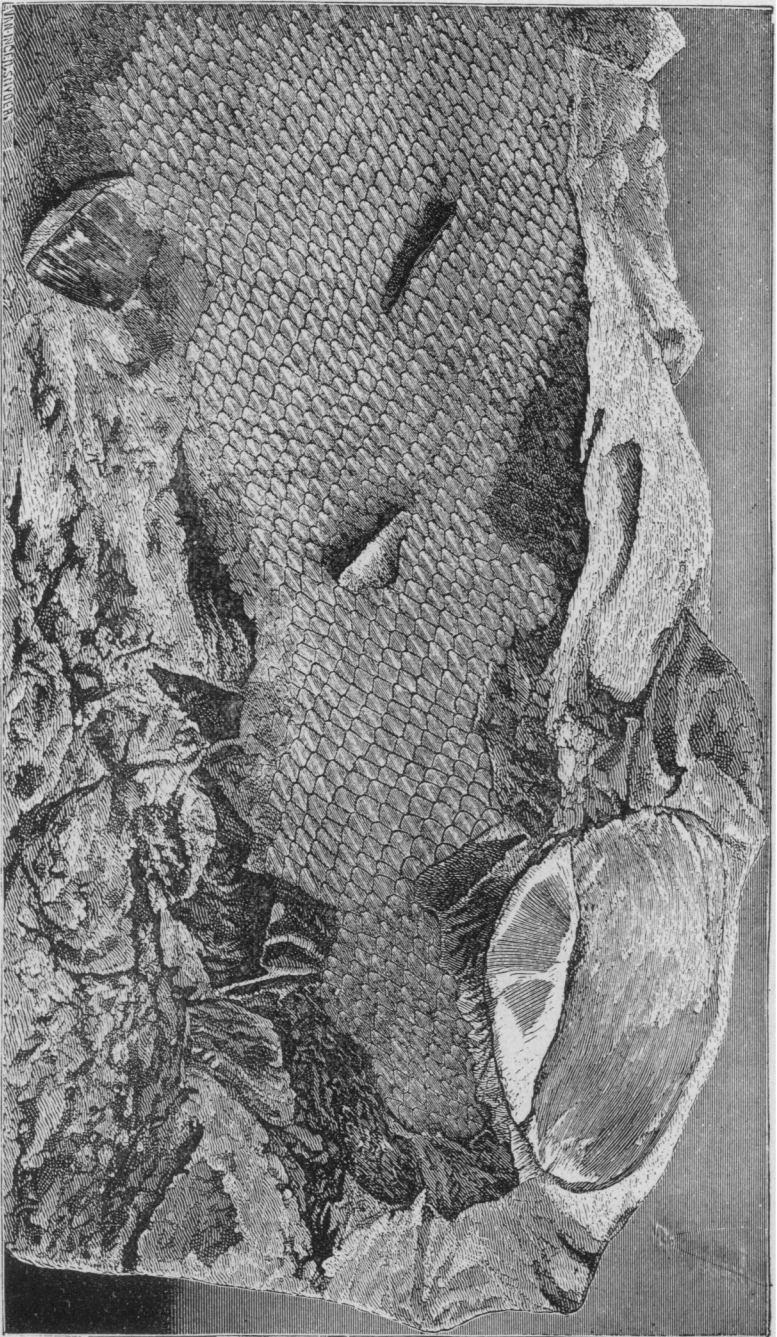
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By Prof. F. H. Snow, of the University of Kansas.

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The geological section of the Kansas University scientific expedition for 1878, in charge of Prof. B. F. Mudge and the writer, examined with care a portion of the blue-gray shales and the yellow limestones along the Hackberry creek, in Gove county, Kansas. These rocks belong to the Niobrara group of the cretaceous formation. The locality had been previously visited by several parties of geological explorers, who had obtained from it many valuable fossils, and it was hardly expected that the gleanings from a field so thoroughly worked would contain anything of unusual value. But the frosts and rains of a single year had exposed to view many remains of fishes and saurians, and our labors were unexpectedly and abundantly rewarded. In less than three weeks, 41 saurians, 117 fishes, and 6 pterodactyls (*Pteranodons*) were discovered, many of them in almost perfect condition, and all of them of sufficient value to justify their transportation for a distance of 300 miles, to take their places in the cabinets of the University.

The most valuable specimen was a saurian, found in the yellow limestone, by the writer. A single vertebral bone was first observed, on June 17th, upon the blue shale at the bottom of a narrow ravine. No further remains were discovered until the following day, when a systematic search was made, in company with my assistant, Mr. L. L. Dyche. We soon detected a second bone, this time one of the phalanges, lying loosely upon the side of the ravine, several feet above the first bone, and a little farther up the ravine. In a few moments more the head of a vertebra was obscurely seen in the face of the solid limestone, about eight feet from the top of



Photographed by A. G. Da Lee, Lawrence, Kansas.  
DERMAL SCALES OF *LIODON* OWEN ( *TYLOSAUURUS* MSH.)

Drawing made by Edw. J. Nolan, Philadelphia.  
(Natural Size.)

the ravine. An hour's work served to detach a block of rock containing several vertebræ and other bones. While removing the superfluous material from this block, in order to facilitate its removal to camp, a fortunate stroke of the hatchet revealed a peculiar reticulated surface, several square inches in extent. The thought instantly flashed upon my mind that here was something which had never before been seen by human eye. The conclusion was irresistible that the reticulated surface was the fossilized covering of the skin of the saurian, so perfectly preserved that every scale was distinctly visible, its outline clearly marked, and the elevated central line, or "carina," unmistakably indicated. Although, according to Prof. Dana's time-ratios, a period of five million years must have elapsed since this saurian swam in the shallow waters of the cretaceous seas of Western Kansas, yet each individual scale exposed to view was as perfectly preserved as if the animal had but yesterday died.

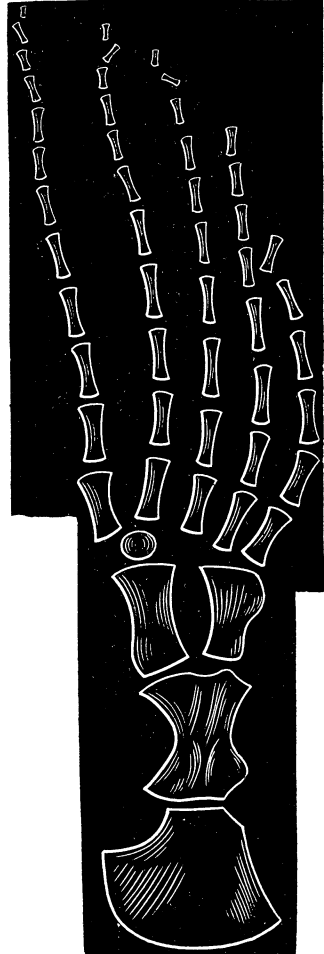
Prof. Marsh, of Yale College, some years ago described the large dermal plates, or scutes, belonging to other mosasauroid genera, which, as he writes me, "appear to be mainly confined to the neck and throat." But, so far as I am able to learn, nothing has been hitherto known of the general covering of the saurian body in any genus, and nothing whatever of the dermal covering in the genus *Liodon*. It might have been expected that this covering would be found to consist of larger plates, like those of the alligator and crocodile. On the contrary, it is composed of small scales, much resembling in size, shape and arrangement, the scales of living Ophidians. Dana, in his *Manual of Geology* (2d Edition, p. 465), speaks of the mosasaurs as "snake-like reptiles." This comparison is strengthened when it is found that their dermal scales were almost an exact pre-figuration of those of the rattlesnake, which infest the ledges within which these saurians are found. The scales first exposed to view appeared to be on the anterior portion of the ventral surface of the body, but another small area was found not far from the pelvic bones. All the scales discovered were on the lower surface of the body, the bones lying above them except in one or two spots where a bone had, by pressure, been forced through the dermal covering. The original surface exposed was afterwards increased in extent, until a total continuous area of thirty-three and one-third square inches was uncovered. This surface contains an average of ninety scales to the square inch, or a total of 3,000 scales. These are all preserved upon a single block of limestone, which also contains several vertebræ, phalanges, and other bones. A comparison with the scales of the living rattlesnake of the plains (*Crotalus confluentus* Say), indicates that the scales of the saurian were somewhat smaller than those of the snake, which, in a full-grown "rattler," average eighty to the square inch, instead of ninety.

On the day after the discovery of this dermal surface, I determined to obtain the remainder of the saurian, which was imbedded in the solid rock. It was necessary to remove eight feet of superincumbent material before the proper level or "horizon" was reached, and also to undermine the specimen, in order to secure the remains in their original position, and, if possible, to expose a larger portion of the dermal covering. After three days and a half of hard labor, by myself and two assistants, we succeeded in removing one large slab, five and one-half feet by two and one-half feet, and six inches in thickness, weighing 500 lbs., and two smaller slabs, each containing the bones of a hind leg and foot. The large slab was found to contain dorsal vertebræ, ribs and pelvic bones, in perfect preservation and apparently without distortion. It also contains one of the forward limbs, or hands, lying underneath the ribs and vertebræ, with the bones in natural

position. In this hand there are forty-seven of the hour-glass-shaped bones of the palm and fingers, the five series consisting respectively of twelve, eleven, ten, eight, and six bones. The terminal or twelfth bone of the first series is very minute, and triangular in shape, or, more exactly, shaped like the half of an hour-glass.

No attempt has yet been made to expose the dermal covering contained in the large slab, and it is exceedingly doubtful if such an attempt would prove successful. The bones imbedded in this slab, and now brought out in relief, are not in their natural position except those of the hand above mentioned. Only two of the twenty vertebræ, which are scattered over the slab in all positions, remain united. The dozen ribs are variously disposed, and one of the thigh bones occupies a spot not far from the center of the lower margin of the slab. The appearance is very much as if some more powerful saurian or shark had devoured the flesh upon the larger bones of the victim, leaving untouched a portion of the skin of the lower surface of the body, and one of the front paddles, which probably did not contain much material for the gratification of his appetite.

In regard to the generic determination of this saurian, I can only say, that of the three well marked genera of the mosasauroid reptiles of the Kansas cretaceous, the specimen seems to agree most accurately with *Liodon* Owen (*Tylosaurus* Marsh). This genus is indicated by the broad neural spines, and by the fact that the number of bones in the first digit of the paddles is the greatest. The specific determination given in the title of this paper will probably be found to be correct. The specimen appears to be a small-sized individual of its species. It is possible that the species may prove to be *micromus* instead of *dyspelor*.



Front Paddle of *Liodon*, as drawn  
by W. H. Simpson

The following measurements are appended:

Dermal scale—	M.
Length .....	.0033
Breadth .....	.0025
Length of "carina" .....	.0037
Dorsal vertebra—	
Length of centrum .....	.075
Length of neural spine .....	.095
Breadth of neural spine, at base .....	.074
Breadth of neural spine, at tip .....	.039
Vertical diameter of cup .....	.058
Transverse diameter of cup .....	.071
Longest rib—	
Tip to tip .....	.381
Along curvature .....	.418
Breadth at base .....	.025
Breadth at tip .....	.009
Breadth at center .....	.012
Femur—	
Length .....	.132
Breadth at proximal end .....	.082
Breadth at distal end .....	.073
Breadth at center .....	.050
Front paddle—total length .....	.726
Coracoid—	
Length .....	.118
Breadth at proximal end .....	.131
Curvature at proximal end .....	.195
Breadth at distal end .....	.056
Distance of perforation from outer edge .....	.026
Distance of perforation from inner edge .....	.042
Humerus—	
Length .....	.122
Breadth at proximal end .....	.074
Breadth at distal end .....	.080
Ulna—	
Length .....	.093
Breadth, proximal .....	.041
Breadth, distal .....	.063
Radius—	
Length .....	.094
Breadth, proximal .....	.047
Breadth, distal .....	.041

In the plates which accompany this article, the dermal scales are represented of natural size, and the slab containing the bones is reduced to one-ninth its natural dimensions.

#### THE IOLA (KANSAS) MINERAL WELL.

By Prof. William K. Kedzie.

At the request of the proprietors, I visited this interesting phenomenon during the month of June, 1876, for the purpose of collecting a supply of